FORM PTO-1390 REV 10-94) U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: 9997.37USWO

U S APPLICATION NO (If known, see 37 C F R 1 5): Unknown 10/009126

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/EP00/04414	5 May 2000	7 May 1999

TITLE OF INVENTION

METHOD FOR ANTICIPATING, DELAYING AND/OR PREVENTING THE RISK OF SPONTANEOUS COMBUSTION AND/OR EXPLOSION OF AN EXPLOSIVE ATMOSPHERE

APPLICANT(S) FOR DO/EO/US

Bertrand DES CLERS

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. [ ] This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(l).
4. [X] A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. [X] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [X] is transmitted herewith (required only if not transmitted by the International Bureau).
   b. [X] has been transmitted by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US)
6. [X] A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. [X] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are transmitted herewith (required only if not transmitted by the International Bureau).
   b. [ ] have been transmitted by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [X] have not been made and will not be made.
8. [ ] A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. [X] An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. [X] A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. [X] An Information Disclosure Statement under 37 CFR 1.97 and 1.98, Form 1449, 4 references, Form PCT/ISA/210.
12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [X] A FIRST preliminary amendment with attached Form PCT/IPEA/409 in French.
    [ ] A SECOND of SUBSEQUENT preliminary amendment.
14. [ ] A substitute specification.
15. [ ] A change of power of attorney and/or address letter.
16. [ ] Other items or information:

ICATION NO. (If known, see 37 C F R 1 5)	INTERNATIONAL APPLICATION NO	ATTORNEY'S DOCKET NUMBER
known 10/009126	PCT/EP00/04414	9997.37USWO

17. [X] The following fees are submitted:

	CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 CFR 1.492(a) (1)-(5)):		
Search Report has been prepared by the EPO or JPO **$890.00**		
International preliminary examination fee paid to USPTO (37 CFR 1.492(a)(1)) **$710.00**		
No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) **$740.00**		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(3)) paid to USPTO **$1040.00**		
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) **$100.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =	**$890.00**	
Surcharge of **$130.00** for furnishing the oath or declaration later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	**$**	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	6 -20 =		X **$18.00**	**$**	
Independent claims	1 -3 =		X **$84.00**	**$**	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ **$260.00**	**$**	
			TOTAL OF ABOVE CALCULATIONS =	**$890.00**	
Reduction by 1/2 for filing by small entity, if applicable. Small entity status is claimed pursuant to 37 CFR 1.27				**$445.00**	
			SUBTOTAL =	**$445.00**	
Processing fee of **$130.00** for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(f).			+	**$**	
			TOTAL NATIONAL FEE =	**$445.00**	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). $40.00 per property			+	**$**	
			TOTAL FEES ENCLOSED =	**$445.00**	
				Amount to be: refunded	**$**
				charged	**$**

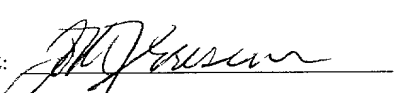
a. [X] Check(s) in the amount of $445.00 to cover the above fees is enclosed.

b. [ ] Please charge my Deposit Account No. _____ in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. [X] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 13-2725.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO
John J. Gresens
MERCHANT & GOULD
P.O. Box 2903
Minneapolis, MN 55402-0903

SIGNATURE: 

NAME: John J. Gresens

REGISTRATION NUMBER: 33,112

S/N unknown PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Bertrand DES CLERS	Docket No.:	9997.37USWO
Serial No.:	unknown	Filed:	concurrent herewith
Int'l Appln No.:	PCT/EP00/04414	Int'l Filing Date:	5 May 2000
Title:	METHOD FOR ANTICIPATING, DELAYING AND/OR PREVENTING THE RISK OF SPONTANEOUS COMBUSTION AND/OR EXPLOSION OF AN EXPLOSIVE ATMOSPHERE		

CERTIFICATE UNDER 37 CFR 1.10
'Express Mail' mailing label number: EV037644423US
Date of Deposit: 7 November 2001
I hereby certify that this correspondence is being deposited with the United States Postal Service 'Express Mail Post Office To Addressee' service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, D.C . 20231.

By: _____
Name: Chris Stordahl

PRELIMINARY AMENDMENT

Box PCT
Assistant Commissioner for Patents
Washington, D. C. 20231

Dear Sir:

In connection with the above-identified application filed herewith, please enter the following preliminary amendment, which is based on claims amended in prosecution of the international application and published in the International Preliminary Examination Report, a copy of which is enclosed herewith:

IN THE ABSTRACT

Insert the attached Abstract page into the application as the last page thereof.

IN THE SPECIFICATION

A courtesy copy of the originally-filed PCT specification is enclosed herewith, but the World Intellectual Property Office (WIPO) copy should be relied upon if it is already in the U.S. Patent Office.

Please add the following paragraph on page 3, line 4.

--The document JP-A-09304310 describes a process for preventing the risk of spontaneous ignition in which the temperature is measured in the sample holding container and in which the critical moment is determined both on the basis of the time which has elapsed and by comparing the measured temperature with the critical temperature. The critical moment of the sample in said process is therefore not literally known.--

IN THE CLAIMS

Please amend the following claims as indicated below. A marked-up copy of all claims is attached for reference.

5. (amended) Process according to claim 1, characterized in that use is made of alarm means or means for preventing spontaneous ignition and/or explosion of said atmosphere when the time elapsed from the moment of creation of said atmosphere approaches the critical moment (T_1) of spontaneous ignition.

6. (amended) Process according to claim 1, characterized in that the implementation of the alarm means and/or means for preventing spontaneous ignition and/or explosion of said atmosphere is engaged manually or automatically.

REMARKS

The above preliminary amendment is made to remove multiple dependencies from claims 5 and 6.

A new abstract page is supplied to conform to that appearing on the publication page of the WIPO application, but the new Abstract is typed on a separate page as required by U.S. practice.

Applicant respectfully requests that the preliminary amendment described herein be entered into the record prior to calculation of the filing fee and prior to examination and consideration of the above-identified application.

If a telephone conference would be helpful in resolving any issues concerning this communication, please contact Applicant's primary attorney-of record, John J. Gresens (Reg. No. 33,112), at (612) 371.5265.

Respectfully submitted,

MERCHANT & GOULD P.C.
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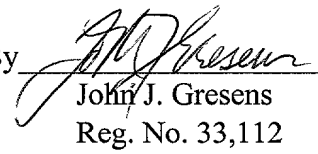
Dated: 7 November 2001

By 
John J. Gresens
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JJG/kjr

ABSTRACT

The invention concerns a method for anticipating and/or delaying and/or preventing the risk of spontaneous combustion and/or explosion of an explosive atmosphere preserved in a confined or semi-confined medium, which consists in measuring the temperature of the mixing from the moment said mixture has been created and determining the critical moment of spontaneous combustion and/or explosion of said atmosphere by determining the unexpired inducting period, on the basis of the time which has elapsed between the creation of said atmosphere and the critical moment beyond which there is a risk of spontaneous combustion and/or explosion of said atmosphere.

MARKED UP COPY OF CLAIMS

5. Process according to [any one of the preceding]claim[s] 1, characterized in that use is made of alarm means or means for preventing spontaneous ignition and/or explosion of said atmosphere when the time elapsed from the moment of creation of said atmosphere approaches the critical moment (T_1) of spontaneous ignition.

6. Process according to [any one of the preceding]claim[s] 1, characterized in that the implementation of the alarm means and/or means for preventing spontaneous ignition and/or explosion of said atmosphere is engaged manually or automatically.

PROCESS FOR ANTICIPATING, DELAYING AND/OR PREVENTING THE RISK OF SPONTANEOUS IGNITION AND/OR EXPLOSION OF AN EXPLOSIVE ATMOSPHERE

Subject of the invention

The present invention relates to a process for anticipating, delaying and/or preventing the risk of spontaneous ignition and/or explosion, under atmospheric conditions, of an explosive atmosphere, that is to say of a mixture of air with flammable substances in the form of gases, vapours, mists, dusts or combustible grains, stored in a confined or semi-confined environment or volume such as a grain silo, a volume comprising a mixture of fuels, hydrocarbons or industrial dusts or of fertilizers and air, the tank of a vehicle, a driftway, etc.

Technical background and prior art underlying the invention

Every year, industrial installations suffer extensive material damage, caused by fires and/or explosions. Occasionally even, this damage is accompanied by loss of life.

Efforts directed towards preventing these risks must thus be made and European Directive 1999/92/EC of 16 December 1999 addresses this matter.

Mixtures of air with one or more flammable substances, defined under the term "explosive atmospheres" by European Directive 1999/92/EC of 16 December 1999, may undergo explosion or ignition when they are stored at ambient or higher temperatures in confined or semi-confined environments.

Such atmospheres may be present in certain volumes such as grain silos, in the interstitial grain

space, in the empty part of the storage cells above the grain, and also in the silo handling galleries in the empty "diamond" cells or intercalations or other confined spaces.

These explosive atmospheres may consist of hydrocarbons and air, of pyrolysis products and air or of aerobic or anaerobic fermentation of wet grain or of dusts arising from grain cleaning, drying or handling operations.

Other open-cast silos are also concerned since the atmosphere inside the stored mixture is explosive and can give rise to "smouldering fires" inside the stored mass or to a fire at the surface of the stored pile.

Explosive atmospheres may also be present in stocks of fertilizers, of animal or plant meals/powders, vehicle tanks, driftways, etc.

Thus, it is important to detect the risk of explosion of these explosive atmospheres.

Document WO 89/08253 describes a process and apparatus for determining whether or not a fuel can cause an explosion under the conditions present in a diesel engine. This phenomenon is studied by subjecting the fuel to exposure in the presence of a mixture of oxidizing gases while gradually increasing the temperature. In a second step, a catalytic post-oxidation reaction to CO_2 and water is carried out and a detector continuously measures the amount of CO_2 produced. The cetane number of the fuel is determined by analysing databases on a statistical model.

Similar devices are described in document WO98/18001, in which different detecting elements (sensors) are used, making it possible to determine the critical proportion of the various components in measuring chambers up to the point of forming an explosive mixture.

However, these various systems are based on a comparison relative to a reference generally determined for a specific volume and mix of fuels.

The document JP-A-09304310 describes a process for preventing the risk of spontaneous ignition in which the temperature is measured in the sample holding container and in which the critical moment is determined both on the basis of the time which has elapsed and by comparing the measured temperature with the critical temperature. The critical moment of the sample in said process is therefore not initially known.

Aims of the invention

The present invention aims to propose a process for anticipating and/or preventing the risk of spontaneous ignition and/or explosion of an explosive atmosphere as defined in Directive 1999/92/EC published in the JOCE L23 of 28/01/00, the fuel mix stored in a confined or semi-confined environment, for example a grain silo, an open-cast coal dust heap, a building whose atmosphere is impregnated with industrial dusts or fertilizers (bags of chemical fertilizer/ammonium nitrate) or with animal or plant powders/meals or saw dust, a tank partially filled with kerosene, petrol, hydrocarbon gases and air, etc., which would not have the uncertainties and drawbacks of the prior art processes and which can be adapted to any type of volume and to any type of fuel (in solid, liquid, emulsified, droplet or gaseous form) in the presence of air, oxygen or another oxidizing agent.

Another aim of the present invention is to propose a device which makes it possible to avoid or delay

the phenomena of spontaneous ignition or explosion of such fuels stored in these confined or semi-confined environments, mixed with an oxidizing agent such as, for example, oxygen or air.

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temperature of the mixture is measured at the time of creation of said mixture, and the critical moment of spontaneous ignition and/or explosion of this mixture is obtained by determining the induction time, that is to say the time elapsed between the creation of said mixture and the critical moment beyond which there is a risk of said mixture spontaneously igniting and/or exploding.

The expression "explosive atmosphere" means a mixture, under atmospheric conditions, of air and of flammable substances in the form of gases, vapours, mists or combustible dusts, in which, after spontaneous ignition, the combustion is propagated throughout the unburnt mixture. If the atmosphere is homogeneous, the spontaneous ignition may take place simultaneously throughout the volume.

According to the invention, the fuel is present in solid, liquid, gaseous, mist, dust or emulsified form.

In the process of the invention, the confined environment comprising the mixture of flammable substances/air is selected from the group consisting of grain silos, centres for storing solid combustible materials such as coal dust, saw dust, fertilizers (chemical fertilizer/ammonium nitrate), animal or plant meals, driftways, fuel tanks, in particular hydrocarbon (kerosene, petroleum spirit, methane, butane, propane, etc.) tanks partially filled with air or with explosive atmospheres, optionally incorporated in a vehicle such as a truck, an aircraft, a boat, etc.

Advantageously, in the process of the invention, alarm means or means for delaying and/or preventing said spontaneous ignition and/or explosion are also used, and may be engaged automatically or, optionally, manually by the staff in charge of monitoring and handling said mixture

present in the confined environment. Said means or devices must be engaged from the moment of creation of the explosive atmosphere in order to determine the critical moment of spontaneous ignition and/or explosion of the explosive atmosphere, that is to say when the time elapsed approaches the critical moment (τ_i) of spontaneous ignition and/or explosion.

These various means may comprise sensors, probes, detectors, analysers or devices for diluting, separating, cooling or inertizing the mixture so as to delay or prevent said spontaneous ignition and/or said explosion.

The various elements for characterizing the critical threshold of spontaneous ignition and/or explosion of the explosive atmosphere are based on the combination of means that are well known to those skilled in the art, such as sensors, recorders, timer systems for determining the time elapsed, devices for measuring the initial temperature and variations in the temperature of the mixture over time, data integration systems such as electronic memories and chips, etc., connected to a central processing and control unit for automatically or manually actuating various alarm devices, for preventing or combating the fire, thus making it possible to prevent, delay or avoid said spontaneous ignition and/or said explosion, and also mechanisms for pumping, emptying, handling, cooling or inertizing the atmosphere at risk or flammable and combustible substances.

Brief description of the drawings :

Figure 1 shows the cell of a grain silo fitted with the device for carrying out the process according to a preferred embodiment of the invention.

Figure 2 shows the connections between the monitoring center and the other elements of the device for

carrying out the process according to a preferred embodiment of the invention.

Figure 3 shows, for different explosive atmospheres, the variations in the logarithm of the induction time τi a function of the initial temperature (in degrees Celsius) of said atmosphere.

Description of one embodiment of the invention :

According to a possible embodiment of the invention, the process for anticipating and/or preventing the risk of ignition and/or explosion concerns a vertical cell filled and emptied by gravity in a grain silo, and uses equipment as shown in Figure 1.

The current knowledge has made it possible to identify, in silos, two main types of accident:

- fires,
- explosions,

the former occasionally being the cause of the latter.

The current state of knowledge regarding prevention and protection starts from the principle that these fires and/or explosions are caused:

- either by a self-heating of the stored products, which results in a first self-ignition, which is then propagated in the atmosphere and the products,
- or by the triggering of an explosion, usually in the handling galleries or towers, filled with flammable dusts, resulting either from a spark originating from a short-circuit on an electrical appliance or from an electrostatic discharge or a local overheating due to the friction of mechanical components.

An aim of the present invention is to use new knowledge which demonstrates that an explosive atmosphere

consisting of a mixture of air, under atmospheric conditions, with flammable substances in the form of gases, vapours, mists or flammable dusts will always undergo a spontaneous ignition (see Figure 3), even at ambient temperature, if the stored volumes are large enough for the wall effects to become negligible at the molecular impact scale. This new knowledge is moreover confirmed by the various itemized studies of self-heating and ignition of flat silos.

In the case of "dusty" atmospheres at high temperature, the induction time, that is to say the time required for the atmosphere to spontaneously ignite, may become very short and there is a risk of ignition taking place simultaneously throughout the volume of atmosphere, giving rise to a more or less violent explosion depending on the energy released (high pressures, heat) and the confinement of the atmosphere.

In this case, the preventive measures must be taken as a matter of urgency, as soon as the explosive atmosphere is created, given that the explosion and its propagation may take only a few seconds or even fractions of a second.

The inventor has chosen to illustrate this invention by its application to a conventional vertical storage cell.

The cell 1 of the silo, of cylindrical shape, comprises at the top a filling hole 2 and an emptying hole fitted with a valve 3 at the bottom.

The cell 1 is also equipped with a hollow cable 4 suspended centrally, containing an inner cable 5 in which are incorporated temperature sensors 6, generally thermocouples, humidity sensors, gas probes, etc., each

spaced apart by a distance which depends on the diameter of cylindrical cell 1.

More specifically, certain parameters are measured and atmospheric samples are taken at a certain number of points inside the cell 1 by means of gas probes 7, beginning from the start of filling.

The samples are subjected to an initial analysis using an analyser 8, the analysis making it possible to introduce, in addition to the initial composition of the atmosphere and its initial temperature, other parameters such as the hygrometry and above all the time elapsed. This sampling will have to be continued either continuously or at a frequency determined by the level of risk of explosion of the atmosphere.

However, it is preferable that the monitoring of the temperature, the time elapsed and the other parameters are performed continuously by means of temperature sensors 6 and humidity sensors 9, these various sensors being placed inside the inner cable 5.

In practice, as soon as the flammable products to be stored with the air filling the cell 1 have been mixed together, means are employed to determine the nature of the mixture and the characteristics of the atmosphere liable to explode, both within the product and in the empty part above the stored product, as illustrated in Figure 2.

Pressure sensors 10 are placed along the inner wall of the cell 1 so as to be able to integrate at any moment the new data into the data already stored in the control and monitoring centre 11. The monitoring centre 11 may thus control, should the need arise, the implementation of the alarm device 12 and/or device for automatic intervention via a programmer 14 and management software 15

in order to reduce and/or neutralize the risk of spontaneous ignition and/or explosion.

Advantageously, the device according to the invention also comprises a recorder 20 intended to record the data relating to the various parameters as they are acquired.

Devices 21 for varying, for example, the humidity, temperature, pressure, etc. are connected to the central processing unit 11.

In addition, the central processing unit 11 controls at output, via control systems 23 (or outputs), the silo machinery, for example the machinery associated with inter-silo transfer, emptying or filling, etc.

Among the processes for neutralizing the risk of spontaneous ignition and/or explosion, mention may be made of the inertization and suction of the atmosphere followed by storage under vacuum.

The inertization process is directed towards neutralizing the reactive nature of the atmosphere by replacing the atmosphere present in the cell 1 with a non-explosive atmosphere, for example by replacing the air (or the oxygen) with a gas such as nitrogen or carbon dioxide. The inert or inertizing gas is taken from bottles 13 as shown in Figure 1 and then injected by means of an injection pump 16 into the cell 1 via the inlet 17.

The process for suction of the atmosphere followed by storage under vacuum or under an inert gas is itself based on the principle according to which it is the oxygen of the air, or that released by certain molecules with which it is associated, that reacts in the atmosphere and makes it explosive. During the induction period which precedes its spontaneous ignition or explosion, it is removed by means of suction pumps 18 as shown in Figure 1

and the storage under reduced pressure or under vacuum is maintained by means of closing the shutter 19. Devices 22 for cooling the atmosphere may be used in conjunction.

The two processes may be carried out in parallel.

It is thus advantageous to include the following elements in the equipment for the vertical cell:

- suction and pumping elements for inertizing the cell at atmospheric pressure and for closing it after inertization;
- or a leaktight membrane installed inside the cell, which is open at the top so as to allow it to be filled and which is provided with a bottom hole, for example to pump the atmosphere and to place the stock under vacuum, until it is emptied out.

Figure 3 gives an example of experimental data which are used as reference by the monitoring centre to decide whether or not to actuate the alarm device 12 and/or the automatic intervention device via the programmer 14 and the management software 15, in order to reduce and/or neutralize the risk of spontaneous ignition and/or explosion. These data correspond to the variations in the induction time, for a fuel/oxidizing agent mixture, as a function of the initial temperature of the mixture. More specifically, Figure 3 shows various data, acquired under constant temperature conditions, with, on the y-axis, the logarithm of the induction time, that is to say the logarithm of the time elapsed between the creation of the fuel/oxidizing agent mixture and the moment of spontaneous ignition and/or explosion, and, on the x-axis, the initial temperature of said mixture. This graph shows a curve based on the sum of various experimental data obtained with fuel mixes in solid, liquid or gaseous form, of blasting powder, benzene, cyclohexane, cyclohexene, lubricants, kerosene,

propane, ethane, n-heptane, etc., in contact or mixed with air.

On the basis of these experimental data, it is possible, for a fuel/oxidizing agent mixture present in a confined environment, provided that suitable experimental techniques are complied with, to anticipate the induction time and thus the moment at which the mixture will spontaneously ignite, thus making it possible to determine the critical elapsed time threshold beyond which said fuel/oxidizing agent mixture is liable to spontaneously burst into flames and thus cause a fire and/or explosion.

As indicated in Figure 3, it should be expected that there will be spontaneous ignition of the interstitial or peripheral atmosphere of the stored products, even though this spontaneous ignition is not preceded by a self-heating. Specifically, the curve in Figure 3 shows the induction time of atmospheres at atmospheric pressure and at constant temperature before spontaneous ignition. Needless to say, this induction time may depend on the nature of the flammable products stored and thus on the physical or chemical change in the interstitial explosive atmosphere after mixing the products with the air contained in the cell before filling.

Legend to Figure 3

COMBUSTIBLES → FUELS

mélanges à de l'air → mixed with air

SOLIDE → SOLID

Poudre noire → Blasting powder

PULVERISATION → SPRAYING

Benzène → Benzene

Cyclo-Hexène → Cyclohexene

Huile de lubrification → Lubricating oil

Kérosène → Kerosene

Ether de Pétrole → Petroleum ether

GAZ → GASES

Gaz de chauffage → Heating gas

GOUTTELETTE → DROPLET

Amended claims

CLAIMS

1. Process for anticipating and/or preventing the risk of spontaneous ignition and/or explosion of an explosive atmosphere stored in a confined or semi-confined environment **chosen from the group consisting of a grain silo, a center for storing coal dust, industrial dusts, animal or plant meals or fertilizers, driftways and fuel tanks optionally incorporated in a vehicle**, in which the temperature of the mixture and any change over time are measured from the time of creation of said atmosphere, and the critical moment of spontaneous ignition and/or explosion of this mixture is determined by determining the induction time remaining to go, **that is to say the time elapsed** between the creation of said atmosphere and the critical moment beyond which there is a risk of said atmosphere spontaneously igniting and/or exploding.

2. Process according to Claim 1, characterized in that the fertilizers are chemical fertilizers or ammonium nitrates.

3. Process according to Claim 1, characterized in that the fuel tanks are tanks of hydrocarbons chosen from the group consisting of kerosene, petroleum spirit, methane, butane and propane.

4. Process according to Claim 1, characterized in that the hydrocarbon tank is a truck, aircraft or boat tank.

5. Process according to any one of the preceding claims, characterized in that use is made of alarm means or means for preventing spontaneous ignition and/or explosion of said atmosphere when the time elapsed

from the moment of creation of said atmosphere approaches the critical moment (τ_i) of spontaneous ignition.

6. Process according to any one of the preceding claims, characterized in that the implementation of the alarm means and/or means for preventing spontaneous ignition and/or explosion of said atmosphere is engaged manually or automatically.

Inventor: Bertrand DES CLERS
Docket No.: 9997.37USWO
Title: METHOD FOR ANTICIPATING, DELAYING AND/OR PREVENTING THE RISK OF SPONTANEOUS COMBUSTION AND/OR EXPLOSION OF AN EXPLOSIVE ATMOSPHERE
Attorney Name: John J. Gresens (Reg. No 33,112)
Phone No.: 612 371.5265
Sheet 1 of 3

WO 00/68684

10/009126

PCT/EP00/04414

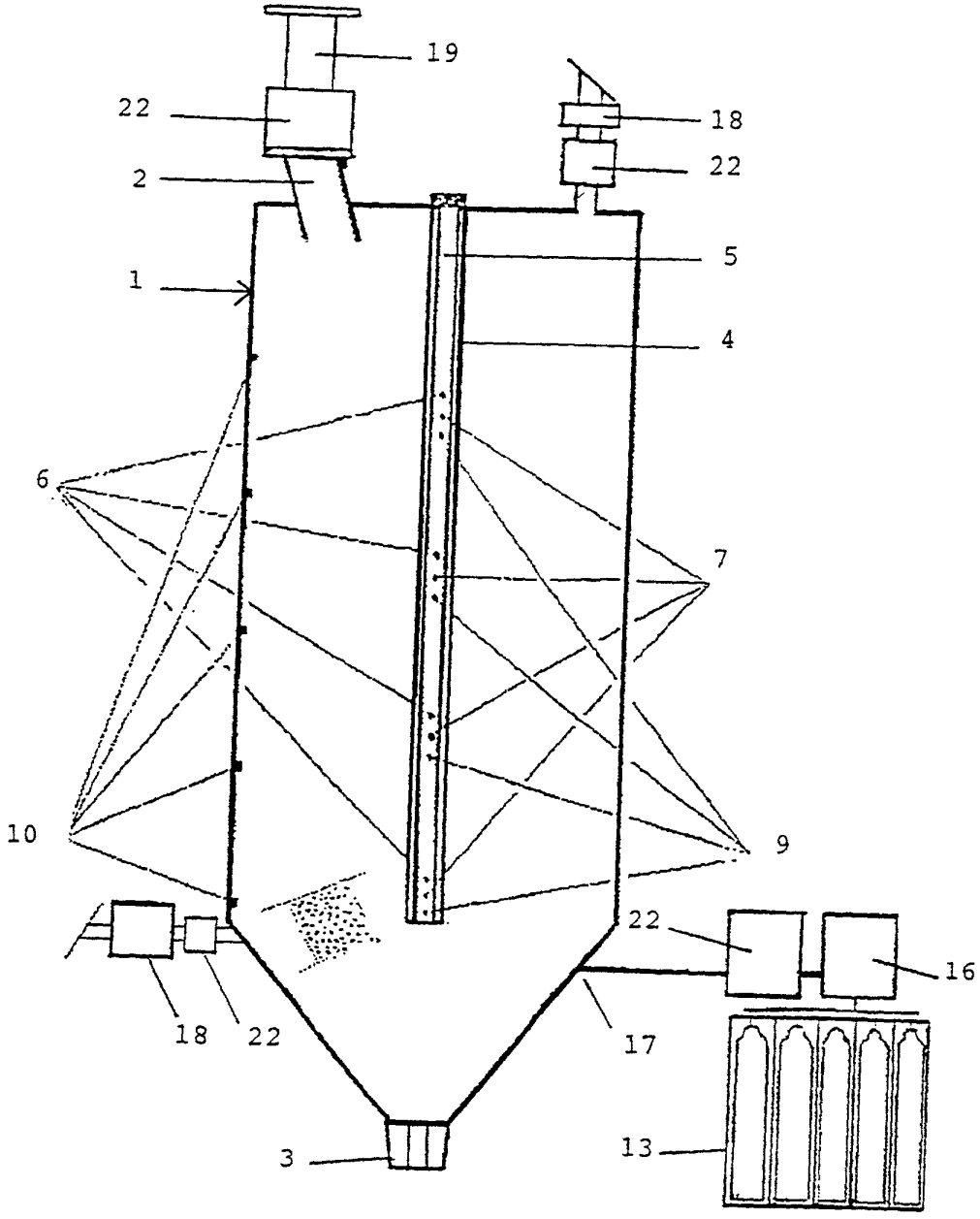

FIG. 1

10/009126

WO 00/68684

PCT/EP00/04414

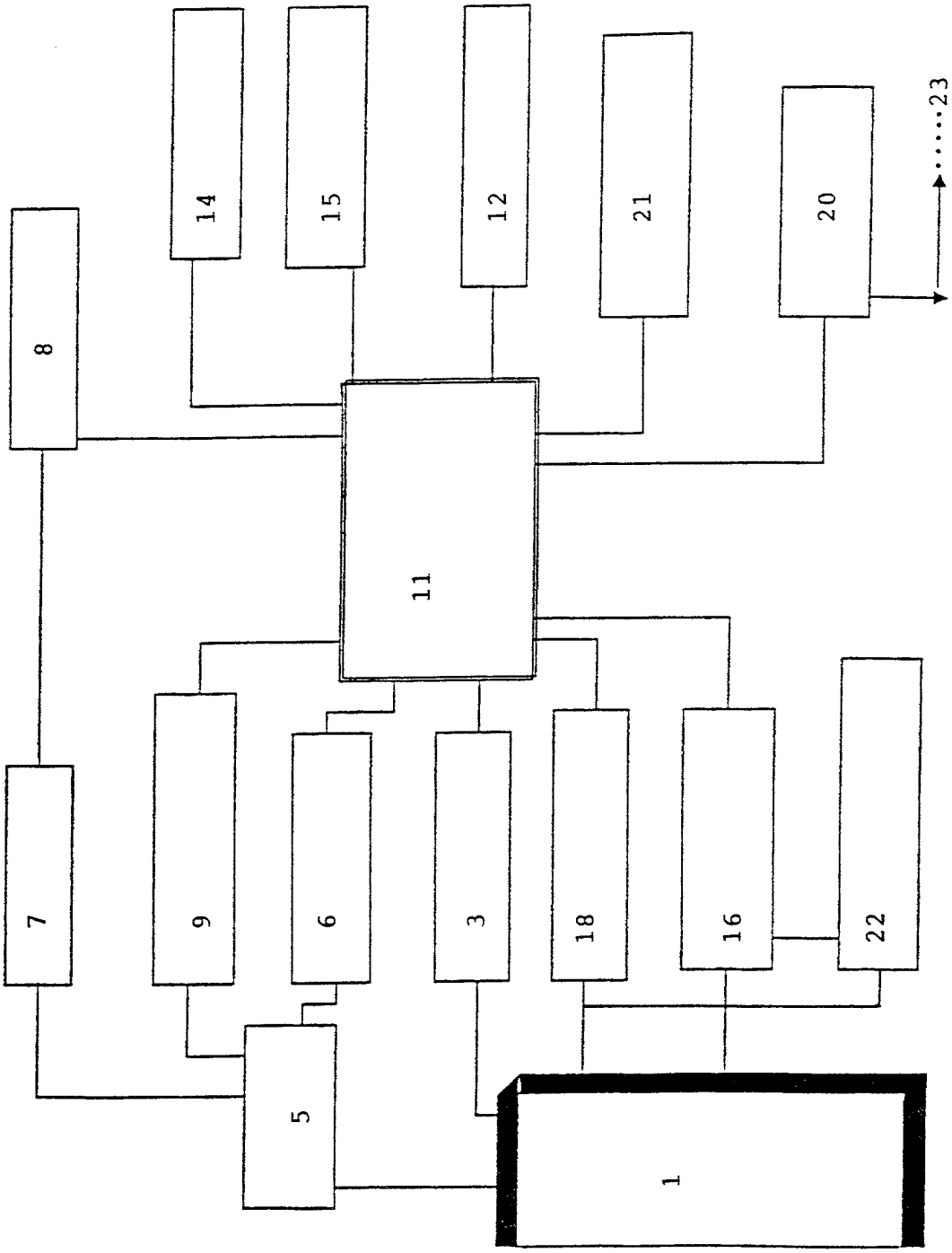

FIG. 2

WO 00/68684

10/009126

PCT/EP00/04414

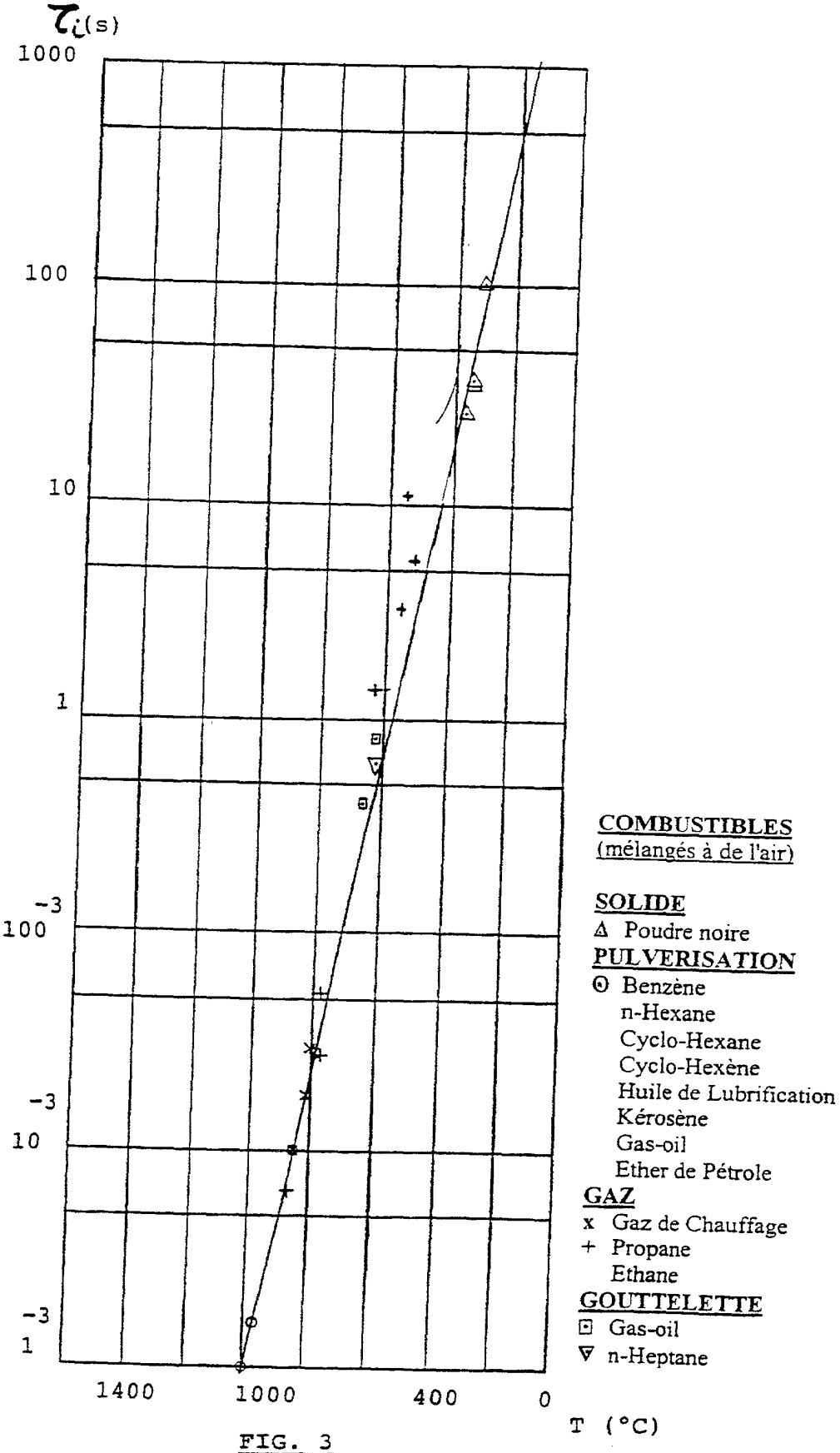

FIG. 3

Declaration and Power of Attorney for Patent Application

Déclaration et Pouvoirs pour demandes de brevet

French Language Declaration

En tant que l'inventeur nommé ci-après, je déclare par le présent acte que :

As a below named inventor, I hereby declare that :

Mon domicile, mon adresse postale et ma nationalité figurant ci-dessous à côté de mon nom,

My residence, post office address and citizenship are as stated below next to my name,

Je crois être le premier inventeur original et unique (si un seul nom est mentionné ci-dessous), ou l'un des premiers co-inventeurs originaux (si plusieurs noms sont mentionnés ci-dessous) du sujet revendiqué, pour lequel une demande de brevet a été déposée concernant l'invention intitulée :

I believe I am the original, first and sole (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled :

Process for anticipating, delaying and/or preventing the risk of spontaneous ignition and/or explosion of an explosive atmosphere

et dont les caractéristiques sont fournies ci-joint à moins que la case suivante n'ait été cochée :

the specification of which is attached hereto unless the following box is checked :

O a été déposé le
sous le numéro de Demande des Etats-Unis ou sous le numéro de demande internationale PCT et modifiée le (le cas échéant).

☒ was filed on 5 May 2000
as United States Application Number or PCT International Application Number PCT/EP00/04414 and was amended on (if applicable).

Je déclare par le présent acte avoir passé en revue et pris connaissance du contenu des caractéristiques ci-dessus, revendications comprises, telles que modifiées par tout amendement dont il aura été fait référence ci-dessus.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

Je reconnais de voir divulguer toute information pertinente à l'examen de cette demande, comme le définit le Titre 37, §1.56 du Code fédéral des réglementations.

I acknowledge the duty to disclose information which is material to patentibility as defined in Title 37, Code of Federal Regulations, § 1.56.

French Language Declaration

Je revendique par le présent acte avoir la priorité étrangère, en vertu du Titre 35, § 119 du Code des Etats-Unis, sur toute demande étrangère de brevet ou certificat d'inventeur figurant ci-dessous et ai aussi pris connaissance de toute demande étrangère de brevet ou de tout certificat d'inventeur ayant une date de dépôt précédant celle de la demande à propos de laquelle une priorité est revendiquée.

I hereby claim foreign priority under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

Prior foreign applications Demande(s) de brevet antérieure(s)		Priority claimed Droit de priorité revendiqué	
BE 9900332	Belgium	7 May 1999	☒ ○
(Number) (Numéro)	(Country) (Pays)	(Day/Month/Year Filed) (Jour/Mois/Année de dépôt)	Yes No Oui Non
(Number) (Numéro)	(Country) (Pays)		○ ○
		(Day/Month/Year Filed) (Jour/Mois/Année de dépôt)	Yes No Oui Non
(Number) (Numéro)	(Country) (Pays)		○ ○
		(Day/Month/Year Filed) (Jour/Mois/Année de dépôt)	Yes No Oui Non

Je revendique par le présent acte tout bénéfice, en vertu du Titre 35, § 120 du Code des Etats-Unis, de toute demande de brevet effectuée aux Etats-Unis figurant ci-dessous et, dans la mesure où le sujet de chacune des revendications de cette demande de brevet n'est pas divulgué dans la demande américaine préalable, en vertu des dispositions de premier paragraphe du Titre 35, § 112 du Code des Etats-Unis, je reconnais devoir divulguer toute information pertinente à la demande de brevet comme défini dans le Titre 37, § 1.56 du Code fédéral des réglementations, dont j'ai pu disposer entre la date de dépôt de la première demande et la date de dépôt de la demande nationale ou PCT internationale :

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentibility as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application :

(Application Serial No.) (No. de série de la demande)	(Filing date) (Date de dépôt)	(Statut) (Breveté, en attente, annulé)	(Status) (Patented, pending, abandoned)
(Application Serial No.) (No. de série de la demande)	(Filing date) (Date de dépôt)	(Statut) (Breveté, en attente, annulé)	(Status) (Patented, pending, abandoned)

Je déclare par le présent acte que toute déclaration ci-incluse est, à ma connaissance, véridique et que toute déclaration formulée à partir de renseignements ou de suppositions est tenue pour véridique; et de plus, que toutes ces déclarations ont été formulées en sachant que toute fausse déclaration volontaire ou son équivalent est passible d'une amende ou d'une incarcération, ou des deux, en vertu de la Section 1001 du Titre 18 du Code des Etats-Unis et que de telles déclarations volontairement fausses risquent de compromettre la validité de la demande de brevet ou du brevet délivré à partir de celle-ci.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful and false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application of any patent issued thereon.

French Language Declaration

POUVOIRS : En tant que l'inventeur cité, je désigne par la présente l'(les) avocat(s) et/ou agent(s) suivant(s) pour qu'il(s) poursuive(nt) la procédure de cette demande de brevet et traite(nt) toute affaire avec le Bureau des brevets et marques s'y rapportant.
(mentionner le nom et le numéro d'enregistrement)

POWER OF ATTORNEY : As named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and trademark Office connected there with.

(list name and registration number)

Adresser toute correspondance à :

Send Correspondence to :

Adresser tout appel téléphonique à :
(nom et numéro de téléphone)

Direct Telephone Calls to :
(name and telephone number)

Nom complet de l'unique ou premier inventeur	Full name of sole or first inventor DES CLERS Bertrand
Signature de l'inventeur Date	Inventor's signature Date 32/02/2001
Domicile	Residence 9 quai Malaquais, F-75006 PARIS (France)
Nationalité	Citizenship French
Adresse postale	Post Office Address 9 quai Malaquais, F-75006 PARIS (France)

(Fournir les mêmes renseignements et la signature de tout co-inventeur supplémentaire)

(Supply similar information and signature for any subsequent joint inventor)